

## The most beautiful biplane of them all? - Hawker Nimrod II

Arguably the most beautiful biplanes ever built and the most famous aircraft serving with Commonwealth forces between the wars were the classic silver Hawker biplanes. The "family" of biplanes started in 1928 with the first flight of the Hawker Hart which was destined to be the new day bomber for the RAF. The Hart's aesthetic lines were due to then-new Rolls Royce Kestrel liquid-cooled V12 engine. The Hart's introduction into the RAF had created a situation where a day bomber was faster than fighters in service at the time. Its success led to the development of new types and derivatives based on its design.

The "family" included the Audax which was created as an Army co-operation aircraft and the need for a Hart type by the Royal Navy led to the Osprey. The Hawker Hind was developed to replace the Hart. The next inevitable stage was to develop a single seat fighter. This led to the Hawker Fury, the first aircraft in RAF service to exceed 200mph. Although the Fury looked generally similar to the Hart it was smaller than its two seat relatives, having a different primary structure and not using the same major components. All of the family of Kestrel-engined Hawker operated throughout the British Empire and with a number of European air forces such as Denmark and Spain.

In 1934 a group of Hawker Furies visited Toronto Flying Club. Whilst there observers from the US Army Air Corps carried out a detailed analysis of the aeroplanes. Their report stated;

*"the British Ships gain speed through the use of geared liquid cooled motors, which allow very clean fuselage design compared to our ships, using the large fuselage cross sectional area required with retractable landing gear". (USAAC)*

*"Above all the power contained at altitude through improved supercharging is responsible for the high velocities obtained with what seemed to be comparatively dirty aeroplanes aerodynamically". (USAAC)*

*"Much of their remarkable climb performance is due to the superior supercharging, in addition they climb by keeping the gross weight down, through the use of wooden propellers, cross axle type landing gear, single lift wires, smaller quantities of fuel and oil because of the superior fuel economy of their engines". (USAAC)*

All that have seen the very rare surviving examples of the Hawker biplanes in the air have remarked about how distinctively beautiful they are. Whilst they have striking looks their sound is striking too. At 21 litres the Rolls Royce Kestrel is only 6 litres smaller than the Merlin and sounds quite similar to it. It is strange to hear the noise one expects from a Spitfire only to see a sleek biplane, so different to anything else in the historic aviation and air display world today.

The new generation of airworthy Hawker biplanes; Nimrod 1 and II, soon be joined by the Fury, would not be flying today without the massive efforts of Guy Black and *Retrotec*, (formerly *Aero Vintage*). Guy has resurrected many of the Hawker engineering techniques that have disappeared over the years. When he first became involved with the Hawker types, the only world's only flying example was the *Shuttleworth Collection's* ex Afghanistan Air Force Hawker Hind.

The most significant of the engineering problems resolved by *Aero Vintage* related to the wing spars. Without the wing spars there was no means by which to properly restore the complete aeroplane. In the 1980's a Fury replica originally owned by the Honourable Patrick Lindsay was constructed. However, it was not possible to manufacture spars, and these ended up being made from wood.

The Hawker biplane uses a complex dumb-bell shape steel spar, conceived by Roland Henry Chapman in 1926, and later patented by Sidney Camm for Hawkers in 1929. This spar is made up of two flanged polygonal booms, folded from high tensile steel strip, riveted to an inter-connected flange. To manufacture such spars today necessitated obtaining special steel from a company with a large strip rolling mill to create steel in coiled strip form although Guy had to go to Switzerland to find such steel. The strip rolling mill is a 60 foot long cast iron table with a number of powered stations turning shaped rollers. Each of these pairs of rollers is different, and various pairs are necessary to form any one section.

The solving of the spar manufacturing problem is giving a new lease of life to a new generation of Hawker aeroplanes, not only the biplanes but also in enabling the restoration of a new generation of Hawker Hurricanes. Additionally, the Hawker biplanes and the Hurricane fuselage rely on tubes squared at the ends. They are assembled in a complex way using stainless steel joining plates with up to 80 separate items per complex joint. The tube squaring machine at *Retrotec* was re-created from photographs of the original Hawker machine. Reverse engineering in the truest sense.

*"Finding skilled people with a knowledge of pre-war engineering practices was very difficult. In the main we have had to train them from scratch. The spars were an enormous problem but we solved it. Engineering problems are a great challenge but finding skilled people is the most difficult. (Guy Black)*

It is Guy's belief that the Hawker biplane design is the result of the aeroplanes requirement to serve throughout the British Empire. As Royal Air Force and Royal Navy resources were spread far and wide, the repair of a welded fuselage type structure would not be possible in many Empire countries in the field. However, as the Hawkers were a cluster of tubes held together by stainless steel plates, spacers, bolts and tubed rivets, if spares were held they could be fitted in place and welding was not required. With no welded joints, there cannot be any movement between parts and hence the use of so many components to stabilise and strengthen each joint. However, the complex manufacture enabled simple maintenance in the field or on board ship.

### **Hawker Nimrod II – Royal Navy Fighter**

To the casual observer the Hawker biplanes "*all look the same*". The Nimrod came to be as the Royal Navy required a single seat biplane fighter, as did the RAF with its Fury. Although the Nimrod looks similar to a Fury the former has maritime additions such as flotation bags, hoisting gear, spare detachable wings, arrester gear and a strengthened fuselage to withstand the stress of catapult launches. The Nimrod II has swept back top wing, enlarged tail and a 600hp Kestrel Mk.V and with a maximum take off weight of 4,050lbs it is about 500lbs heavier than the Fury and has a wingspan 3ft greater than the RAF fighter.

K3661, manufacturer serial 41H.59890, was completed on 5th September 1934. On 1st January 1935 it was placed in storage at Cardington and then on 7th October 1936 went to the packing depot at RAF Sealand. It was issued to 802 Flight in the Mediterranean on 23rd October 1936 with the side code number 562 and it served from 1936 to June 1938 when it suffered two landing accidents. It was placed on Admiralty charge on 23rd May 1939 and then sent to Lee on Solent in December 1939.

In 1972 the Nimrod was discovered on a rubbish dump in Ashford, Kent, more or less complete but well corroded. It was recovered and donated to the RAF Museum who stored it at RAF Henlow. After Henlow's closure the fuselage was sold off to Mike Cookman from whom Guy Black acquired the fuselage in August 1991.

Investigating the aeroplane's past, Mike Llewellyn, the proprietor of the Battle of Britain Museum at RAF Hawkinge, telephoned Guy with the news of a display case full of parts from the Nimrod, including control column, instrument panel, map box, ammunition chutes, and many other items, including the original cockpit data plates, confirming the serial number as K3661. It is believed the aircraft may have ended its service as an airfield decoy.

The restoration of the K3661 commenced in 1992. British Aerospace were helpful in the early days of the project but it is unfortunate that full sets of drawings were destroyed by students working for them some years back. The discovery of a large number of drawings in Denmark enabled the restoration to progress further and the K3661, now registered G-BURZ, made its first post-restoration flight in November 2006.

Much valuable data had been gained from the development and testing of the first Hawker Nimrod 1 S1581, the first of *Retrotec's* Hawkers to complete its restoration which took eight years. 1581 made its first post-restoration flight in July 2000 and paved the way as the first of the *Retrotec* "production line". It was operated by Duxford-based *Historic Aircraft Collection* for two years and went through a test schedule very similar to the programme that it would have flown in the 1930's. It was handed over to the *Fighter Collection* in September 2002 in exchange for Hurricane Mk.XII G-HURI.

It would be remiss of me in writing about flying the aeroplane in this article without recognising the quite incredible work that took place to get it back in its true element.

### **Flying the Nimrod II**

#### **First Impressions**

Just looking at the aeroplane as you walk out to it generates thoughts of the RAF Hendon Air Days and Royal Navy Reviews of the 1930's. One is immediately struck by its sheer beauty from any angle and it makes you feel as if you should be dressed in all-whites to fly it – and I have been! It looks every inch the predecessor to the Hurricane from every angle, just look at it and imagine it without its top wing. When parked on the line for an airshow next to a Hurri it is even more evident.

The Nimrod is a big aeroplane and it is quite a climb getting into the aeroplane, it feels a bit like going up by the North-West route! You must be particularly careful not to put your feet through the beautiful fabric work. Sitting in the cockpit is a bit like looking out of a foxhole with its being very narrow at the shoulders, although there is plenty of room inside but if the weather is overcast it can be quite dark in there. It is not just the outside view of the aeroplane which sets the mind back to halcyon days of flight; the cockpit with its dials, brass fittings and Vickers S gun breeches is equally evocative.

### **Ready to Start**

The Nimrod normally requires two groundcrew to prepare it for flight and assist with the start. For a Spitfire it can need three hands for the pilot to start, the Nimrod can take four! It has three means of starting; a Gas Start system, by using a Huck's Starter vehicle, or by two groundcrew winding starter handles.

The fuel system is a main tank of 46 gals with 2 x 16 gall wing tanks for a total of 78 gals of fuel. Main Tank ON/OFF fuel cock ON. Reach up to the upper wing and pull the T handle of the Port wing tank outwards and thus ON, I leave the Starboard wing tank T handle in OFF as a reserve. Head back into the cockpit and working by my usual left-to-right; Throttle – Closed, Mixture control RICH (Fully back), All Magnetos – there are Main and Hand Starting Magnetos - OFF.

Now ready to use the complicated gas start system. The system works by means of compressed air and vapourized fuel turning the engine on start up. Mags OFF, Gas Starter Master Cock - a tap on the cockpit floor - OFF. I call "*ready to gas prime*" and the Drain cock of the starter vaporizer is opened through a hole in the Starboard engine cowling by one of the groundcrew whilst I unscrew the plunger of the gas start which looks like a second primer above the main fuel priming pump. The gas start prime pump is operated about 10-15 times – or as long as it keeps squeaking - until fuel flows from the vaporizer drain cock when the crew signal me and close the drain cock. I lock the gas start priming pump in the cockpit

Next the engine is fuel primed with 5 or 6 "good strokes" i.e. with pressure. I reach down by my right foot on the cockpit floor to the Gas Starter Master Cock and turn the tap ON. Call the crew "*Clear*". I raise my right hand and signal winding and call "*Contact*". Switch on the hand starting starter magneto switch, then furiously wind the handle of the hand starting magneto and then depress the Gas Starter Press Cock on the cockpit floor with my right heel. As soon as the engine fires the main magnetos are switched ON and the Hand starting magneto OFF. With the engine firing I reach down and turn the Gas Starter Master Cock tap to closed. That's all there is to it! As a coordination exercise starting the Nimrod II is like patting your head and rubbing your stomach whilst still needing your third arm to scratch your back.

The alternative starting methods can also be just as daunting initially. Seeing a Model T Ford based Hucks Starter vehicle pull up in front of your propeller and connecting up to it is an alien experience for those of us who try to keep everything away from our propeller arcs. After the Hucks Starter has been engaged into the propeller, Fuel ON, Magnetos OFF, throttle open slightly. No need to gas prime so Fuel prime with 6 "good strokes". Ready to start, "*contact*", the ground crew start up the Hucks, Hand Starting Magneto Switch ON, wind the handle of the Hand Starting Magneto as the shaft of the Hucks Starter turns the propeller. As soon as

the engine fires the main magnetos are switched ON and the Hand starting magneto OFF. The Hucks Starter shaft releases as the engine fires and then the crew reverse the Hucks away. I would add that the Hucks is chocked so that it cannot go forward into the propeller.

There is the third option of having the groundcrew hand winding the propeller. This is by means of two starting handles connecting each side of the Kestrel engine. This is available as a fail-safe option if the gas starter is u/s or a Hucks is not readily available! However this is used only as a final back-up option.

Although the Hucks Starter is a crowd pleaser and the team will use it at shows like Flying Legends, the Gas Start system is very practical once mastered and enables operations away from the *Historic Aircraft Collection* home base at Duxford.

### **Warming Up**

What a sound! I initially warm up at 600rpm and check the Oil Pressure is rising. Open the throttle gradually between 1000-1200 rpm taking care not to long idle. It is necessary to avoid running the Kestrel at gear or crankshaft "periods" of 820, 1080 RPM and about 1200 RPM. With the Oil temp at 15°C and Water temp at 60°C I check the magnetos for a slight drop and then check the slow running. I open the radiator shutters, verified open by the crew and I am ready to taxi.

Signal chocks away and taxi out, check the brakes; left, right and both. K3661 has a pneumatic differential brake system fitted which helps considerably with the need to be a practical aeroplane and to suit modern airfields and hard runways and gives good confidence in the aeroplane. The brakes are activated by using the converted gun triggers on the stick and are the most notable improvement from the Nimrod 1. Weaving to look ahead either side of the nose with rudder and the occasional hand-nudge of brake as I taxi up to the Duxford hold

### **Checks before Take Off**

Brakes on and engine check at 1400 rpm. The usual TTMMPPFFGGHH before take off whilst keeping a close eye on the temperatures. It's a biplane with the unique need in the display world today to watch coolant temperatures although it does hold its temperature well whilst on the ground with its radiator set permanently in the propwash.

**T** - Stabiliser Trim in Take Off position – central, **Th**rottle Friction - tight **M**ixture Full **R**ICH, **M**ags already checked, **F**uel ON main and Port Wing tank, **R**ad Flap - Open, **G**auges, **G**yros, **H**arness and **H**atches.

With pre-takeoff checks complete, taxi out and line up, look ahead, taking care to check the sight picture off to the sides of the long V12 filled nose in preparation for any swing. Open the throttle smoothly whilst anticipating the swing and being careful not to open the throttle too quickly. The crescendo of noise which characterises a liquid-cooled V-12 such as the Merlin is taken to a whole new deafening level with the 21 litres of the very rare Rolls-Royce Kestrel up front is only 6 litres smaller than a Merlin but with the open cockpit of the Nimrod the noise is considerable. From stick back at the start of the run relax and feel the force on the elevators, the tail gently comes up; the swing is held well by the rudder very similar to the feel of the Hurricane and then maintain a slightly tail-down attitude, base of the exhaust stacks on the horizon. Taking the boost up to +2.5lbs (+6 maximum)

feels sufficient. With 600+ horsepower up front the 4,000 lb Nimrod goes off like the proverbial cork in a bottle in just a few seconds, it takes much longer to describe than it takes to do!

Once airborne check the engine temperatures; maximum oil temp (90° C) and the max coolant temp are all well within limits and get the boost back to +1.5lbs. There is a 5 min limit of +1.5 lbs boost with throttle at the gate.

The climb attitude normally looks very flat from the ground but gives at rate of climb of 2000ft/min despite the nose-low attitude. Throttling back to normal cruise at -1.5lbs boost the airspeed settles at 140mph and head to the North of Duxford for some general handling practice.

Look for a good area for stalling, in this instance within gliding range of Bourn airfield. Throttling back the Kestrel does not feel a very comfortable experience. It has a light wooden two-bladed propeller that at idle turns so slowly that one can feel the engine telling you that it does not like it. However we need to stall and must get the aeroplane slowed down to do so.

As the engine protests at being taken back to idle it is better to keep on just a trickle of power on and there is just a slight airframe buffet and thus little warning occurring before the impending stall, a Hurricanesque tendency. The nose drops with a slight wing drop, at as estimated 53 mph. I then fly some tight turns for some accelerated stalls. Again there is little warning of departure but a quick recovery is achieved with the aeroplane "unloaded". However a key point is to keep your feet busy i.e keep the needle in the middle – no ball here – and keep the aeroplane in balance.

I set up for a brief aerobatic sortie with my primary concerns being not to exceed the RPM and boost limitation at high speed. No help like the Hurricane's Merlin has with its Constant Speed Unit to assist the engine-handling. The Kestrel is such a rare engine that great care must be taken with the engine limits. Although it is a supercharged V-12 its fixed pitch propeller requires Tiger Moth rather than Spitfire style engine handling.

Starting with a series of wingovers and 360's to "warm up". The minimum recommended speed for entry to a loop is 170 mph although I prefer to use 200mph to be on the safe side, and can have enough energy to carry out a second loop on completion of the first. Barrel rolls – for which the Nimrod II feels like it was made - with 170 to 180mph entry with one eye on the boost and rpm throughout. Like a Hurricane it feels like you have to keep "on it" all of the time i.e feeding in pitch inputs and using the rudder throughout. The rudders are certainly not just for footrests in the Nimrod! The Max Permissible Diving Speed (Vne) is 215mph and there is a 5 minute limit of 2900rpm although I keep well within these numbers throughout. In present times such rare aeroplanes as the Nimrod II do not have to do 300mph terminal velocity dives or inverted spinning with floats as they would have done back in the 1930's.

I am often told by visitors to Duxford that they look up to expect a Spitfire diving in to the overhead only to be surprised to see the beautiful silver biplane – to quote Flying Legends commentator Bernard Chabbert - "snarling". It is a display aircraft that requires careful energy management. The sound of the Kestrel up increases

significantly as I dive in get the speed for an aerobatic display, for a formation display I will usually be a little further back on the boost. Throughout any routine I am conscious as always that I am looking after the Kestrel engine and I must keep to within the +1.5lbs 5 minute limit. Mid routine in a display and looking down through Nimrod II's lovely silver wings, it cannot help but conjure up thoughts of the Hendon Air Pageants of the 1930's at which Nimrods appeared.

I complete my last pass of a display at 100ft and then pull up and turn to wash the speed off climbing into the downwind, this keeps the Nimrod II tight in to the circuit. BUMPFHH; Brakes OFF and check air supply pressure sufficient, Undercarriage is already down of course – but don't assume as you could be in a Hurri next time! Mixture Fully RICH, Prop is fixed of course, Fuel ON, Harness and Hatches, power back and trim to get the speed at the end of the downwind leg to 80mph. Abeam the runway threshold start the curved approach *a la* Spitfire to Duxford's grass runway 24.

Keep the curve approach going and with a smidgen of power as the Kestrel prefers. I gently straighten up at 30ft and into the flare still keeping a touch of power on at 75mph, if the power is cut too soon the nose will drop – just as with the Hurricane. Flare and fly on, wing down into wind, into a gentle tail-down wheeler, cut the power and keep the tail off of the runway for as long as is possible with progressive forward stick until the tail drops, then stick hard back and keep it straight, fingers ready on the brakes. The nose wants to go left or right seemingly without reason and it is a matter of anticipating the swing with the quite excellent differential brakes. Keep it straight and then stop and clear to the right, stick hard back. Stop and vacate the runway.

Check the temperatures – all OK – and taxi back carefully keeping an eye on the t's and p's. Pull in and stop, hand signal to crew brakes ON, the crew put chocks in, brakes then off and then I go into the shutdown checks. Idle rpm, Magneto dead cut check, Mags and fuel off and the Kestrel stops. Brakes off and then depress the Gas Starter Press Cock to confirm it is not live, all done. Wonderful.

Flying the Nimrod is such a privilege as it is one of the world's rarest fighters and such a classic type in aviation history. It is an aeroplane extinct until *Retrotec's* incredible efforts in recent years and thanks to *Historic Aircraft Collection* Principals Angus Spencer-Nairn and Guy and Janice Black for giving me the opportunity to fly this beauty. Having seen the aeroplane through various stages of its resurrection over the years I appreciate more than most what a truly incredible job it was to get the Nimrod II back in the air again after so long an absence. Flying the Nimrod is a joy, displaying it? – priceless.

The Nimrod II presents such wonderful opportunities for air displays. I have flown with the Seafire, showing two Royal Navy frontline fighters of different generations. There are opportunities ahead for displays with the Hurricane, the famous successor to the Nimrod and Fury, and with other 1930's service types such as the Swordfish and Gladiator.

The most beautiful biplane ever to fly? Beauty is in the eye of the beholder except that in the case of the Hawker Nimrod II it is in the eye – and the EAR – of the beholder. Watch and LISTEN to this silver marvel – and then tell me that it is not!

**Howard Cook  
2009**

**Length:** 26 ft 5 in (8.09 m)

**Wingspan:** 33 ft 6 in (10.23 m)

**Height:** 9 ft 8 in (3.00 m)

**Wing area:** 300 ft<sup>2</sup> (27.96 m<sup>2</sup>)

**Max Take off Weight:** 4,050 lb (1,841 kg)

**Powerplant:** 1× Rolls Royce Kestrel V inline piston engine, 600 hp

**Endurance:** 2 hours

**Maximum Speed:** 168 knots (194 mph, 311 km/h)

**Service ceiling:** 28,000 ft (8,535 m)

2 × forward firing fixed .303 (7.7 mm) machine guns

4 × 20 lb (9 kg) bombs on underwing racks